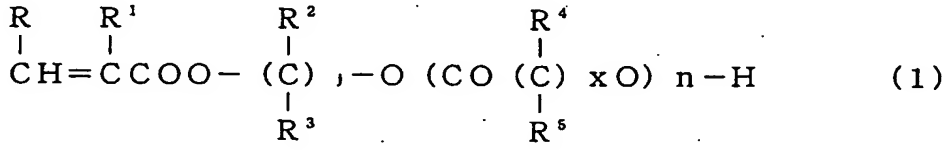
Scope of Claims

1. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones in which a proportion of monomers having two or more continuous chains ($n \geqq 2$) of lactones is less than 50% (area % by GPC), the composition being represented by formula (1) described below,



(1)

(in the formula, R, R^1, R^2, and R^3 are independently a hydrogen or a methyl group, "j" is an integer of 2-6, xn pieces of R^4 and R^5 are independently a hydrogen or an alkyl group having a carbon number of 1-12, "x" is 4-7, "n" is 0 or an integer of not less than 1, and an average value of "n" in a composition is not less than 0.3 to less than 1.0).

2. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in claim 1, wherein a hydroxyalkyl(meth)acrylate which is employed as a raw material is a hydroxyethyl(meth)acrylate.

3. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in claim 1, wherein a lactone monomer which is employed as a raw material is ε-caprolactone and/or valerolactone.

4. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in claim 1, wherein the content of a lactone monomer remained in the composition is 0-10% by weight.

5. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in claim 1, wherein the content of a hydroxyalkyl(meth)acrylate remained in the composition is not less than 20% by weight and not more than 50% by weight.

6. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in claim 1, wherein the content of a di(meth)acrylate which is a by-product in said composition is not more than 2% by weight.

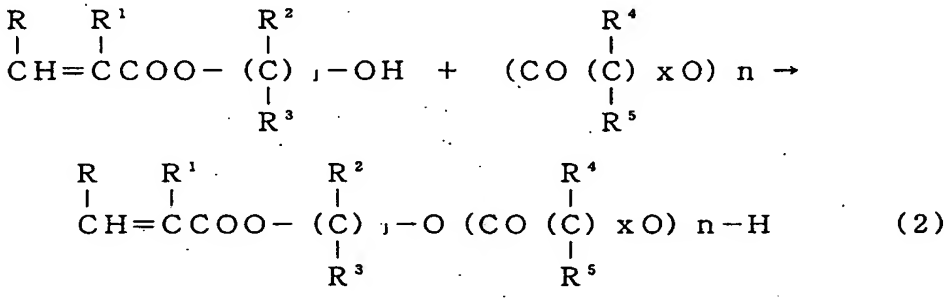
7. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in claim 1, wherein the content of by-products produced by side reactions such as a Michael addition, an acrylic polymerization, a transesterification, and other side reactions is not more than 10% by weight in said composition.

8. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 1-7, wherein catalyst to be employed for a ring-opening polymerization in the preparation of said composition is less than 1000 ppm (weight) based on total amount of materials to be fed.

9. A hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 1-8, wherein the amount of a polymerization inhibitor for the hydroxyalkyl(meth)acrylate to be employed for a ring-opening polymerization in the preparation of said composition is not more than 1% by weight based on total amount of materials to be supplied.

10. An acrylic polyol resin obtained using a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 1-9 as a component for polymerization.

11. A method for the preparation of a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones wherein a proportion of monomers having not less than 2 continuous chains (n≧2) of lactones is less than 50% by mol (GPC area %), characterized in that a hydroxyalkyl(meth)acrylate is allowed to react with a lactone in a reaction molar ratio of more than 1 in the case of preparing the polylactone-modified hydroxyalkyl (meth)acrylate through allowing to react the hydroxyalkyl (meth)acrylate with a lactone monomer by ring-opening polymerization according to a reaction represented by a general formula (2) described below,



(2)

(in the formula, R, R^1, R^2, and R^3 are independently a hydrogen or a methyl group, "j" is an integer of 2-6, xn pieces of R^4 and R^5 are independently a hydrogen or an alkyl group having a carbon number of 1-12, "x" is 4-7, "n" is 0 or an integer of not less than 1, and an average value of "n" in a composition is not less than 0.3 to less than 1.0).

12. A method for the preparation of a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones as claimed in claim 11, wherein said hydroxyalkyl(meth)acrylate is hydroxymethylacrylate or hydroxyethylmethacrylate.

13. A method for the preparation of a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones as

claimed in claim 11 or 12 wherein said lactone monomer is ε-caprolactone and/or valerolactone.

14. A method for the preparation of a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 11-13, wherein an average value of n in said composition is not less than 0.35 and not more than 1.0.

15. A method for the preparation of a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 11-13, wherein the content of said lactone remained in said composition is 0-10% by weight.

16. A method for the preparation of a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 11-13, wherein the content of the hydroxyalkyl (meth)acrylate remained in said composition is not less than 20% by weight and not more than 50% by weight.

17. A method for the preparation of a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 11-13, wherein the content of a di(meth)acrylate which is a by-product in the composition is not more than 2% by weight.

18. A method for the preparation of a hydroxyalkyl (meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 11-13, wherein the content of by-products produced by side reactions such as a Michael addition, an acrylic polymerization, a transesterification, and other side reactions is not more than 10% by weight in said composition.

19. A method for the preparation of a hydroxyalkyl

(meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 11-18, wherein the amount of a catalyst to be employed in the reaction of the lactone with the hydroxyalkyl(meth)acrylate is less than 1000 ppm (by weight) based on total amount of materials to be fed.

20. A method for the preparation of a hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones as claimed in any one of claims 11-18, wherein the content of a polymerization inhibitor for the lactone and the hydroxyalkyl(meth)acrylate is not more than 1% by weight based on total amount of materials to be fed.

21. A curable resin composition comprising 0.5-80 parts by weight of an acrylic polyol resin (A) obtained using a hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones represented by the above-described formula (1) as claimed in claim 1, in which a proportion of monomers having not less than 2 continuous chains ($n \geqq 2$) of lactones is less than 50% (GPC area %), as polymerizing components, and 0.5-50 parts by weight of a melamine resin (B), total of the (A) and (B) not exceeding 100 parts by weight.

22. A curable resin composition as claimed in claim 21, wherein said hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones is obtained using a hydroxyethyl (meth)acrylate.

23. A curable resin composition as claimed in claim 21 or 22 wherein the hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones is obtained using ε-caprolactone, δ-valerolactone, γ-butyrolactone, or a mixture thereof.

24. A curable resin composition as claimed in any one of claims 21-23, wherein said acrylic polyol resin (A) is composed of 5-70 parts

by weight of the hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones, 0-90 parts by weight of an alkyl(meth)acrylate having a carbon number of 1-20, 0-30 parts by weight of a (meth)acrylic acid, and 0-40 parts by weight of other polymerizable unsaturated monomer.

25. A curable resin composition as claimed in any one of claims 21-24 wherein said acrylic polyol resin (A) has a hydroxyl group value of 5-250 and a number average molecular weight of 3,000-300,000.

26. A melamine-curable type water-based coating composition comprising 5-30 parts by weight of an acrylic polyol resin (A) obtained using a hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones represented by the above-described general formula (1) as claimed in claim, wherein a proportion of monomers having not less than 2 continuous chains ($n \geqq 2$) of lactones is less than 50% (GPC area %), as polymerizing components, and 10-60 parts by weight of an amino-plasto resin (IV-B).

27. A melamine-curable type water-based coating composition as claimed in claim 26, characterized by composing of (i) 3-40% by weight of the hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones, (ii) 1-20% by weight of α, β-unsaturated carboxylic acid, (iii) 1-25% by weight of an N-alkoxymethyl (meth)acrylate having a carbon number of 1-6 in an alkyl group, and (iv) an aromatic vinyl monomer and an alkyl(meth)acrylate which are contained in an amount that 100% by weight minus total weight % of the above components (i), (ii), and (iii).

28. A melamine-curable type water-based coating composition as claimed in claim 26 or 27, wherein said acrylic polyol resin (A)

has a number average molecular weight of 2,000-50,000, a hydroxyl group value of 10-150 mg-KOH/g, and a Tg point of 0-60 C.

29. A melamine-curable type water-based coating composition as claimed in any one of claims 26-28, wherein said amino-plasto resin (IV-B) is at least one of a guanamine resin (k) selected from a melamine resin (j), benzoguanamine, spyroguanamine, acetoguanamine, and phthaloguanamine, and/or a melamine-guanamine cocondensed resin (l).

30. A melamine-curable type water-based coating composition as claimed in any one of claims 26-29, which is employed for cars, home electric appliances, and cans for beverages and foods.

31. A curable resin composition comprising 50-90 parts by weight of an acrylic polyol resin (V-A) obtained using a hydroxyalkyl(meth)acrylate composition (a) modified by small amount of lactones, represented by the above-described general formula (1) as claimed in claim 1, in which a proportion of monomers having not less than 2 continuous chains ($n \geq 2$) of lactones is less than 50% (GPC area %), and 50-10 parts by weight of a polyisocyanate compound (V-B), total of the (V-A) and (V-B) not exceeding 100 parts by weight.

32. A curable resin composition as claimed in claim 31, wherein said acrylic polyol resin (V-A) is composed of 5-65% by weight of the hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones, 0-30% by weight of a vinyl monomer having hydroxyl group, and other vinyl-based monomers (residual weight).

33. A curable resin composition comprising 0.5-80 parts by weight of an acrylic polyol resin (VI-A) having carboxylic group and a functional group obtained by allowing to react a hydroxyalkyl(meth)acrylate composition (a) modified by a small amount

of lactones, represented by the general formula (1) claimed in claim 1, wherein a proportion of monomers having not less than 2 continuous chains (n ≧2) of lactones is less than 50% (GPC area %), with a vinyl monomer having carboxylic group and other vinyl monomers, and 0.5-50 parts by weight of a polyisocyanate compound (VI-B), total of the (VI-A) and (VI-B) not exceeding 100 parts by weight.

34. A curable resin composition as claimed in claim 33, wherein said acrylic polyol resin (VI-A) is a vinyl-based copolymer having carboxylic group and a functional group, said copolymer being obtained by allowing to react a reaction product of a hydroxyl group-contained resin and a (meth)acrylic anhydride with a vinyl-based monomer having carboxylic group and other vinyl-based monomers, said hydroxyl group-contained resin being obtained by polymerizing a hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones.

35. A curable resin composition as claimed in claim 33, wherein said acrylic polyol resin (VI-A) is a resin obtained using said hydroxyl group-contained resin as claimed in claim 34 and at least one selected from a urethane resin having hydroxyl groups, an epoxy resin having hydroxyl groups, a cellulose derivative having hydroxyl groups, and a polyester resin having hydroxyl groups.

36. A curable resin composition as claimed in claim 33 wherein said acrylic polyol resin (VI-A) is a resin obtained using said hydroxyl group-contained resin claimed in claim 34 and a urethane resin having hydroxyl groups.

37. A curable resin composition as claimed in claim 33 wherein said polyisocyanate compound (VI-B) is a polyisocyanate compound

containing an epoxy resin.

38. A curable resin composition as claimed in any one of claims 31-37, wherein said hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones is a product obtained using hydroxyethyl(meth)acrylate.

39. A coating characterized by containing (i) crosslinked particles obtained by dispersing a mixture of an acrylic polyol resin (VI-A) with a polyisocyanate compound (VI-B) into a water-based medium and by crosslinking thereof, or (ii) composite-type crosslinked particles composed of a urethane-urea/ethylene-based resin obtained through polymerizing polymerizable ethylenic unsaturated compounds containing a hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones in water in which crosslinked urethane-urea particles are dispersed, as resin components for forming a thin layer.

40. A coating as claimed in claim 39 characterized by containing not less than 50% by weight of crosslinked particles having particle diameter of not more than 1 m and, moreover, an average molecular weight between crosslinking points within a range of 300-2,000, as resin components for forming a thin layer.

41. A coating as claimed in claim 39 or 40, wherein said crosslinked particles have a layer-formable temperature of not more than 100℃.

42. A coating as claimed in any one of claims 39-41, wherein said content of the crosslinked particles is not less than 70% in said resin components for forming a thin layer.

43. A coating as claimed in any one of claims 39-42, characterized by containing 1-25% by weight of a crosslinking agent together with

the crosslinked particles as said resin components for forming a thin layer.

44. A coating as claimed in any one of claims 39-43, characterized by further containing a thin layer-formable resin having a reactive group other than the crosslinked particles as said resin components for forming a thin layer.

45. A coating as claimed in any one of claims 39-44, wherein said crosslinked particles contain pigments in an inside thereof.

46. A thermosetting resin composition which comprises 2-50 parts of an acrylic polyol resin (VII-A) containing a hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones represented by the general formula (1) as claimed in claim 1, wherein a proportion of monomers having not less than 2 continuous chains ($n \geq 2$) of lactones is less than 50% (GPC area %), and 30-80 parts of an acrylic copolymer (VII-B) having an alkoxysilyl group, total of the (VII-A) and (VII-B) being 100 parts by weight.

47. A thermosetting resin composition as claimed in claim 46, wherein said acrylic polyol resin (VII-A) has at least one kind selected from an acid anhydride group, an epoxy group, amino group, and carboxylic group.

48. A thermosetting resin composition as claimed in claim 46 or 47, wherein said acrylic copolymer (VII-B) having an alkoxysilyl group has a group represented by general formula (VII-3) described below,

$$(R^6O)_{3-a}-\overset{R^7{}_a}{\underset{|}{Si}}-\overset{R^8}{\underset{|}{CH}}- \qquad (VII-3)$$

(in the formula, R^6 represents an alkyl group having a carbon number of 1-10, R^7 and R^8 are a hydrogen atom or a monovalent hydrocarbon group selected from an alkyl group, an aryl group, and an aralkyl group which have a carbon number of 1-10, "a" is the number of a substituent group, and it represents an integer of 0, 1, or 2).

49. A thermosetting resin composition as claimed in claim 48, wherein said acrylic copolymer (VII-B) having an alkoxysilyl group has at least one kind selected from an acid anhydride group, an epoxy group, amino group, and carboxylic group.

50. A thermosetting resin composition as claimed in claim 48 or 49, wherein said acrylic copolymer (VII-B) having an alkoxysilyl group has a number average molecular weight of 1,000-30,000.

51. A thermosetting resin composition as claimed in any one of claims 48-50, wherein said acrylic copolymer (VII-B) having an alkoxysilyl group contains 5-90% by weight of an alkoxysilyl group-contained monomer (VII-b) having a polymerizable unsaturated double bond as a polymerizing component.

52. A thermosetting resin composition containing 0.1-20 parts by weight of a catalyst (VII-C) for curing based on 100 parts by weight of a thermosetting resin composition as claimed in any one of claims 48-51.

53. A thermosetting resin composition as claimed in claim 52, wherein said catalyst (VII-C) for curing is an organic tin compound, an acidic phosphate, a mixture or reaction product of the acidic phosphate with an amine, a saturated or unsaturated polyvalent carboxylic acid, a saturated or unsaturated polyvalent carboxylic anhydride, a reactive silicone compound, an organic titanate compound,

an organic aluminum compound, or a mixture thereof.

54. A top coat clear coating comprising a thermosetting resin composition as claimed in any one of claims 46-53.

55. A method for the preparation of a carboxylic group-contained acrylate composition (a') modified by a small amount of lactones represented by a general formula (VIII-3) described below characterized by allowing to react a hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones represented by the above-described general formula (1) claimed in claim 1 in which a proportion of monomers having not less than 2 continuous chains (n ≧2) of lactones is less than 50% (GPC area %) with a carboxylic acid or anhydride thereof (VIII-b) represented by a general formula (VIII-2) described below,

$$R^9\text{-}[COOH]_{m+1} \qquad (\text{VIII}-2)$$

$$CH=C(R)COO-(C(R^3))_j-O(CO(C(R^4)(R^5))_x O)_n-C(=O)-R^9\text{-}[COOH]_m \qquad (\text{VIII}-3)$$

(in the formula, R, R^1, R^2, and R^3 are independently a hydrogen or a methyl group, "j" is an integer of 2-6, xn pieces of R^4 and R^5 are independently a hydrogen or an alkyl group having a carbon number of 1-12, "x" is 4-7, "n" is 0 or an integer of not less than 1, an average value of "n" in said composition is not less than 0.3 to less than 1.0, R^9 is a residual group of a carboxylic acid, and "m" is an integer of 1-3).

56. A method for the preparation of a carboxylic group-contained acrylate composition (a') modified by a small amount of lactones as claimed in claim 55, characterized in that a reaction of said

hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones with said carboxylic acid or anhydride thereof (VIII-b) is conducted at a temperature range of 40-160℃.

57. A method for the preparation of a carboxylic group-contained acrylate composition (a') modified by a small amount of lactones as claimed in claim 55 or 56, characterized in that a reaction of the hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones with said carboxylic acid or anhydride thereof (VIII-b) is conducted under the presence of oxygen and a polymerization inhibitor.

58. A method for the preparation of a carboxylic group-contained acrylate composition (a') modified by a small amount of lactones as claimed in any one of claims 55-57, characterized in that 0.9-1.1 mol of said carboxylic acid or anhydride thereof (VIII-b) is allowed to react with 1 mol of said hydroxyalkyl(meth)acrylate composition (a) modified by a small amount of lactones.

59. A curable resin composition which comprises 10-70 parts of an acrylic polycarboxylic acid resin (A') containing said carboxylic group-contained acrylate composition (a') modified by a small amount of lactones, represented by the general formula (VIII-3) as claimed in claim 55, in which a proportion of monomers having not less than 2 continuous chains ($n \geqq 2$) of lactones is less than 50% (GPC area %), as a polymerizing component, and 10-80 parts of a polyepoxide (IX-B).

60. A curable resin composition as claimed in claim 59, characterized in that said carboxylic group-contained hydroxy(meth)acrylate composition (a') modified by a small amount of lactones is obtained by allowing to react said

hydroxyalkyl(meth)acrylate composition modified by a small amount of lactones, represented by the general formula (1) as claimed in claim 1, in which a proportion of monomers having not less than 2 continuous chains ($n \geq 2$) of lactones is less than 50% (GPC area %), with said carboxylic acid or anhydride thereof represented by general formula (VIII-2) as claimed in claim 55.

61. A curable resin composition as claimed in claim 60, characterized in that said carboxylic group-contained hydroxy(meth)acrylate composition (a') modified by a small amount of lactones is obtained by allowing to react 0.9-1.1 mol of said carboxylic acid or anhydride thereof with respect to 1 mol of said hydroxy(meth)acrylate composition (a) modified by a small amount of lactones.

62. A curable resin composition as claimed in any one of claims 59-61, characterized in that said acrylic polycarboxylic acid resin (A') is a copolymer of 5-80% by weight of a carboxylic group-contained ethylenic unsaturated monomer with 20-95% by weight of an ethylenic unsaturated monomer not having carboxylic group, provided that the ratio of the carboxylic group-contained hydroxy(meth)acrylate composition (a') modified by a small amount of lactones is 5-50% by weight in said the acrylic polycarboxylic acid resin (A'), and said copolymer has at least two carboxylic groups on average in the molecule and an acid value of 5-300 mgKOH/g-solid and a number average molecular weight of 500-8000.

63. A curable resin composition as claimed in any one of claims 59-62, characterized in that said acrylic polycarboxylic acid resin (A') having terminal carboxylic group is an acrylic polycarboxylic

acid resin (bA') in which carboxylic groups are blocked by a blocking group which can produce carboxylic groups by heat and/or water.

64. A curable resin composition as claimed in any one of claims 59-63, characterized in that said polyepoxide (IX-B) is an acrylic polyepoxide having an epoxy equivalent of 50-700 and a number average molecular weight of 200-10000.

65. A curable resin composition as claimed in any one of claims 59-64, characterized in that said polyepoxide (IX-B) is a polyepoxide having hydroxyl group and an epoxy group which is obtained by copolymerization of 5-70% by weight of (i) a hydroxyl group-contained ethylenic unsaturated monomer having a structure represented by general formula (4) described below with 10-60% by weight of (ii) an epoxy group-contained ethylenic unsaturated monomer and 0-85% by weight of (iii) an ethylenic unsaturated monomer not having an epoxy group which is optionally added,

$$CH_2=CCO\text{-}X\text{-}OH \qquad (4)$$

(in the formula, R is a hydrogen atom or a methyl group, and X is an organic chain shown by formula (5) described below or an organic chain shown by formula (6) described below,

$$-O\text{-}Y\text{-}(OCO\text{-}(CH_2)_m\text{-})_q\text{-} \qquad (5)$$

(in the formula, Y is a linear or branched alkylene group having a carbon number of 2-8, "m" is an integer of 3-7, and "q" is an integer of 0-4),

$$-O(O\text{-}CH_2\text{-}CH(R)\text{-})_n\text{-} \qquad (6)$$

(in the formula, R is a hydrogen atom or a methyl group, and "n" is

an integer of 2-50).

66. A curable resin composition as claimed in any one of claims 59-65, and which further contains 0.1-10 parts by weight of an antioxidant (IX-C).

67. A curable resin composition as claimed in any one of claims 59-66, and which further contains 5-70 parts by weight of a polyester polycarboxylic acid (IX-D) having an acid value of 30-350 mg-KOH/g-solid.

68. A curable resin composition as claimed in any one of claims 59-67, and which further contains 0.1-10 parts by weight of crosslinked resin particles (IX-E).

69. A clear coating composition containing a curable resin composition as claimed in any one of claims 59-68 as a binder.

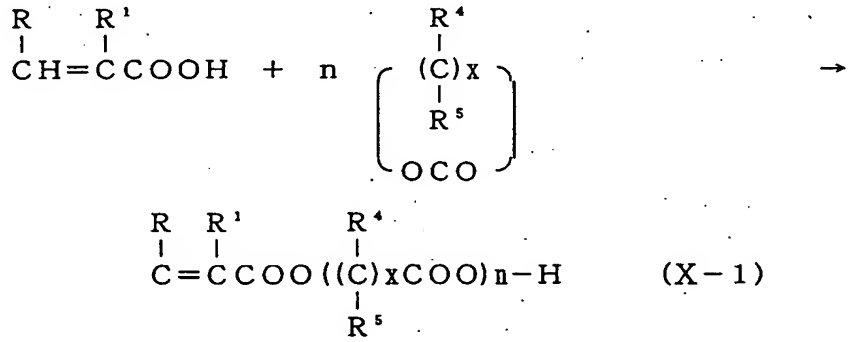
70. A method for coating which comprises a step in which a water-based or a solvent-based base coating is coated on a substrate coated by under-coating or internally-coating; a step in which a clear coating composition as claimed in claim 69 is coated on the base coating without curing a layer of said base coating; and a step in which said layer of said base coating and a layer of said clear coating composition are cured by heating.

71. A polyester unsaturated monomer composition modified by a small amount of lactones, in which a proportion of monomers having not less than 2 continuous chains ($n \geq 2$) of lactones is less than 50% (GPC area %), which is obtained by a ring-opening polymerization of a lactone monomer with respect to a polymerizable unsaturated monomer containing carboxylic group.

72. A polyester unsaturated monomer composition modified by

a small amount of lactones as claimed in claim 71, wherein said polymerizable unsaturated monomer containing carboxylic group is at least one kind selected from a group consisting of a (meth)acrylic acid, itaconic acid, β-(meth)acryloyloxyethyl succinic acid, β-(meth)acryloyloxyethyl maleic acid, β-(meth)acryloyloxyethyl phthalic acid, maleic acid, a monoalkyl maleate (a carbon number in an alkyl group is 1-12), tetrahydrophthalic acid, and an anhydride thereof.

73. A polyester unsaturated monomer composition modified by a small amount of lactones as claimed in claim 72, wherein said polymerizable unsaturated monomer containing carboxylic group is a (meth)acrylic acid, and which is obtained by a reaction represented by formula (X-1) described below,



(X-1)

(in the formula, R and R^1 are independently a hydrogen or a methyl group, xn pieces of R^4 and R^5 are independently a hydrogen or an alkyl group having a carbon number of 1-12, "x" is 4-7, "n" and "n" in said composition are 0 or an integer of not less than 1, and an average value of "n" in said composition is not less than 0.3 to less than 1.0).

74. A polyester unsaturated monomer composition modified by a small amount of lactones as claimed in any one of claims 71-73, wherein

said lactone monomer is ε-caprolactone and/or valerolactone.

75. A polyester unsaturated monomer composition modified by a small amount of lactones as claimed in any one of claims 71-74, characterized in that the proportion of monomers having not less than 2 continuous chains ($n \geq 2$) of lactones is less than 40% (GPC area %).

76. A polyester unsaturated monomer composition modified by a small amount of lactones as claimed in any one of claims 71-75, wherein the content of said lactone monomer remained in the composition is 0-10% by weight.

77. A polyester unsaturated monomer composition modified by a small amount of lactones as claimed in any one of claims 71-76, wherein the content of said remained polymerizable unsaturated monomer containing carboxylic group is not less than 20% by weight and not more than 50% by weight.

78. A polyester unsaturated monomer composition modified by a small amount of lactones as claimed in any one of claims 71-77, wherein the content of a di(meth)acrylate of said polymerizable unsaturated monomer containing carboxylic group which is a by-product in said composition is not more than 2% by weight.

79. A polyester unsaturated monomer composition modified by a small amount of lactone as claimed in any one of claims 71-78, wherein the content of by-products produced by side reactions such as a Michaels addition, an acrylic polymerization, a transesterification, and other side reactions is not more than 10% by weight.

80. A polyester unsaturated monomer composition modified by a small amount of lactone as claimed in any one of claims 71-79, wherein the amount of a catalyst to be employed in said ring-opening

polymerization is less than 1000 ppm (by weight) based on total amount of materials to be fed.

81. A polyester unsaturated monomer composition modified by a small amount of lactone as claimed in any one of claims 71-80, wherein a polymerization inhibitor is not more than 1% by weight based on total amount, which is employed for a (meth)acrylic acid in said ring-opening polymerization.

82. A method for the preparation of a polyester unsaturated monomer composition modified by a small amount of lactone, wherein 0.3-less than 1.0 mol of a lactone monomer is polymerized by ring-opening with respect to 1 mol of a radically polymerizable unsaturated monomers containing carboxylic group, whereby, a proportion of monomers having not less than 2 continuous chains ($n \geqq 2$) of lactones is adjusted to less than 50% (GPC area %).

83. A method for the preparation of a polyester unsaturated monomer composition modified by a small amount of lactone as claimed in claim 82, wherein an acidic catalyst is a Lewis acid or a Br nsted acid.

84. An acrylic resin using a polyester unsaturated monomer composition modified by a small amount of lactone as claimed in any one of claims 71-81.

85. A method for the preparation of a polyester unsaturated monomer composition modified by a small amount of lactone, characterized in that 0.3-less than 1.0 mol of a lactone monomer is polymerized by ring-opening with respect to 1 mol of a radically polymerizable unsaturated monomer containing carboxylic group using a stannous halide, monobutyltin tris-2-ethylhexanate, stannous octoate, dibutyltin

dilaurate, or a mixture thereof as a catalyst, followed by separating the unreacted radically polymerizable unsaturated monomer containing carboxylic group.

86. A method for the preparation of a polyester unsaturated monomer composition modified by a small amount of lactone as claimed in claim 85, wherein the catalyst to be employed in said ring-opening polymerization is less than 1000 ppm by weight based on total amount to be fed.